

REMARKS

The applicant respectfully requests reconsideration in view of the amendment and the following remarks. Support for amended claim 12 can be found on page 3, line 37 of the specification. Support for newly added claims 23-25 can be found in claim 12 and the specification at page 3, line 37.

The specification and abstract are objected to because of informalities. The applicant has amended the specification and abstract as suggested by the Examiner. The applicant has incorporated the first preliminary amendment and added the appropriate headings and Brief Description of the Figures. The applicant corrected the typographical errors pointed out by the Examiner. The applicant has also amended the abstract. Enclosed is a marked up specification (Appendix 2) and a clean copy of the specification (Appendix 3). The substitute specification does not contain new matter.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (US 2002/0165092 A1) ("Zhang") in view of Meyer et al. (US 6,413,905) ("Meyer"). The applicant respectfully traverses this rejection.

Zhang discloses a catalyst for selective hydrogenation of alkynes and dienes, its preparation process and application. According to paragraphs 0015 to 0019, the catalyst according to Zhang comprises an inorganic oxide support selected from alumina, titania or a chemical composite of alumina and titania, Pd in an amount of about 0.002 to 1.0 % based on the total weight of the catalyst and one or more promoters selected from Group IB metals, wherein the mole ratio of palladium to the group IB metal is in range between 1 and about 20. According to paragraph 0034 Group IB metals are Cu, Ag and Au. According to paragraph 0036 of Zhang, the catalyst can also comprise alkali metals and/or alkali earth metals, being Li, Na, K, Rb and Cs, Be, Mg, Ca, Sr and Ba, in an amount of 0.05 to 20% of the total weight of the catalyst.

This disclosure of Zhang teaches a person having ordinary skill in the art that a catalyst comprising a support made of titania and/or alumina shall contain palladium as an active component, in addition to one or more promoters selected from Group IB metals, being Cu, Au or Ag, and optionally comprising 0.05 to 20% of the total weight of the catalyst of an alkali metal and/or an earth alkali metal.

In contrast to the disclosure of Zhang, the applicant's claim 12 claims a palladium catalyst consisting of a supported from 0.05 to 2.0% by weight, based on the supported catalyst

of palladium, from 0.02 to 1.0% by weight, based on the supported catalyst of titanium and from 0.0002 to 7.4% by weight, based on the supported catalyst, of potassium, wherein the rest of the catalyst is the support.

The following differences between the catalyst that is disclosed in Zhang and the catalyst which is claimed in the applicant's claim 12 are as follows:

First, the catalyst of the present application comprises from 0.02 to 1.0% by weight, based on the supported catalyst, titanium in elemental form, where as Zhang discloses that titanium shall be present as the support material in the form of titanium dioxide. Zhang does not disclose that titanium shall be present as metal in an amount of 0.02 to 1.0% by weight, based on the supported catalyst.

In addition, the palladium catalyst according to the applicant's claim 12 can consist of a support and of palladium, titanium and potassium in the mentioned amounts. The definition of these catalysts using the wording consisting defines the palladium catalyst according to claim 12 in a way that only the support and the mentioned metals are present. This is further underlined by the wording "wherein the rest of the catalyst is the support." This means further that no group IB metal is present in the catalyst as disclosed in Zhang as an essential component.

Zhang further discloses that any alkali metal and/or earth alkali metal can be present in a catalyst. In contrast to this disclosure, claim 12 of the present application a palladium catalyst is claimed comprising of 0.0002 to 7.4% by weight, based on the supported catalyst, of potassium.

These differences between the teaching of Zhang and the palladium catalyst according to claim 12 of the present application make it possible that new catalysts are obtained which have high ethylene selectivity in a process for hydrogenation of acetylene even after reduction at lower temperatures in the catalyst preparation or in the catalyst regeneration step. This advantageous behavior can be shown by the examples of the applicant's specification.

In example 1 on page 5, a Pd-Ti-K-catalyst on SiO₂ support is prepared. In example 2, a comparative catalyst is prepared comprising no titanium and no potassium. In example 3 a comparative catalyst is prepared, comprising no potassium. In example 4 a comparative catalyst according to example 3 is prepared, except that the catalyst was reduced at a higher temperature of 500°C.

According to example 5, chemisorption experiments are conducted. The results are shown in table 1 on page 7. It can be seen that catalyst A according to claim 12 of the present

application shows the lowest amount of CO adsorbed (0.26) and the highest area ratio of linearly-bound CO(A_l)/multiply-bound CO(A_m), although this catalyst is reduced at a lower temperature of 300°C compared to catalyst D.

In example 6 XPS-experiments are conducted in order to analyze the concentration of Ti and Pd on the catalyst surface before and after reduction. The results are shown in the table on pages 7 and 8 of the description. It can be seen that the Ti/Pd-ratio of catalyst A after reduction is nearly twice as high compared to catalyst C. The Ti/Pd-ratio of the Pd-Ti-K-catalyst is remarkably increased even after reduction at lower temperature of 300°C. In example 8, catalysts E to H are prepared, being the same catalysts as catalysts A to D, except for the molar ratio of K/Ti/Pd. In example 9, acetylene hydrogenation reactions are conducted in order to investigate the effect of the amounts of added K on the ethylene selectivity. The reaction results are plotted in Fig. 2. It can be seen that as the amount of K increases, the ethylene selectivity is increased until the ratio of K/Pd is 0.1 (catalyst A), and then is decreased as the amount of added K increases to above certain amounts (catalysts E-H). The existence of the excessive K increases the formation of oligomer such as 1,3-butadiene and consequently, degrades the activity and selectivity of a catalyst. Therefore, the optimal ratio of K/Pd is 0.1, which is in accordance with the amounts of metals according to claim 12 of the present application (see page 9, lines 20 to 32 of the specification).

The further experiments show advantageous properties of the palladium-lanthanum-catalyst and of the palladium-lanthanum-silicon-catalyst which are further claimed in claim 12 of the present application.

The experiments which are presented in the description clearly show that the presence of potassium in a very specific amount gives rise to improved properties of the Pd-Ti-K-catalyst according to claim 12 of the present application.

Zhang does not disclose that a catalyst consisting of a support and of palladium, titanium and potassium in the specific amounts as claimed in claim 12 of the present application gives rise to the improved properties that can be shown in the examples mentioned above. Zhang teaches that at least one group IB metal has to be present in a catalyst in order to give a high activity. The examples that are discussed above clearly show that this is not the case, but that potassium shall be present in a very specific molar ratio in respect to Pd, in order to improve the properties. Zhang only teaches that any alkali metal and/or alkali earth metal should be present in nearly any

amount. Zhang does not point in the direction that the specific amount of potassium gives rise to the improved properties.

Meyer discloses supported catalysts and their use in hydrogenation reactions. According to column 3, lines 24 to 29, catalytically active metals are metals of groups I, VII and VIII of the periodic table of the elements, wherein particular preference is given to using Pd and Pt. According to column 2, line 66 to column 3, line 4, a modifier shall be present, being chosen from transition group IV, V, VI or VIII of the periodic table of the elements, being for example titanium, zirconium, etc.

Suitable supports according to Meyer are chosen from alumina, silica, titania, zirconia, alumina silicates, magnesia and activated carbon, see column 2, lines 57 to 62.

Meyer also does not disclose that an advantageous catalyst shall comprise potassium in a very specific amount in order to have a very specific molar ratio between palladium and potassium present in the catalyst. Therefore, from the applicant's point of view, Meyer can not point in the direction of the very specific palladium catalyst, consisting of the support, palladium, titanium and potassium, as it is claimed in claim 12 of the present application.

Therefore, the palladium which are claimed in claim 12 of the present application are non-obvious in light of Zhang, Meyer or in light of a combination of both. For the above reasons, this rejection should be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 13156-00018-US from which the undersigned is authorized to draw.

Dated: March 27, 2008

Respectfully submitted,

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